LOS HONGOS DE COLOMBIA — VIII
SOME NEW SPECIES OF SOIL FUNGI FROM COLOMBIA

Por

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ABSTRACT

Three new Colombian microfungi are described. *Trichoderma inhamatum* Veerkamp & W. Gams and *Rhinocladiella phaeophora* Veerkamp & W. Gams were isolated from a maizefield soil near Acacías, Dep. Meta, at 500 m alt.; *Mortierella ornata* W. Gams was isolated from a soil sample from mountain forest, Parque Nacional del Puracé, Cauca-Huila, at 3.100 m alt.

RESUMEN

Tres nuevos hongos colombianos son descritos: *Trichoderma inhamatum* Veerkamp & W. Gams y *Rhinocladiella phaeophora* Veerkamp & W. Gams fueron aislados de una muestra de suelo agrario (campo de maíz) vecino de Acacías, Dep. del Meta, a 500 m de altitud; *Mortierella ornata* W. Gams fue aislada de una muestra de suelo de bosque andino, Parque Nacional del Puracé, Cauca-Huila, a 3.100 m de altitud.

In 1978 the senior author analysed microfungi isolated from two Colombian soil samples by means of a soil washing technique (Veerkamp, 1978). The samples were taken on 18 Feb. 1978 by O. Rangel from maize and cassava fields, 25 km south of Villavicencio on the road to Acacías, Dep. Meta, at 500 m altitude. The maizefield soil was sandy, with a rather high organic mater content, pH 6.5 (5.8 in 1N KC1). Besides 89 known fungal species of general occurrence in tropical (and partly also temperate) soils, two of the taxa isolated from the maize field appear to be new.

The second author has repeatedly received soil samples from the paramo and subparamo zones for fungal analyses. In these humose, more or less acidic soils, *Mortierella* species occur commonly and one very distinct new species is described here; other interesting species will be dealt with in subsequent studies.

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Trichoderma inhamatum Veerkamp & W. Gams, sp. nov. Fig. 1.

Coloniae celeriter crescentes, floccosae, in medio atrovirides ad atroherbaceae; reversum hyalinum. Odor debilis, Trichodermatis typicus. Conidiophora abunde, dense pyramidaliter ramosa, appendicibus sterilibus plerumque carentia; rami principales 3.5-4.0 μm, subterminales 2.0-2.5 μm lati. Phialides fere irregulariter acervatae, lageniformes, e ventro inflato, 2.3-3.0(-3.5) μm lato et collulo angusto, 0.5-1.0 μm longo constantes, omnino 4-5 μm (terminales ad 8 μm) longae. Conidia globosa ad modice ovoidea, levia, matura sub microscopio viridia, 2.3-3.0 x 2.0-2.6 μm. Chlamydosporae globosae, hyalinae, 4.5-6 μm diam. in coloniis vetustis. Teleomorphosis ignota.

Holotypus COL., Leg. *O. Rangel s. n.* (vivus CBS 273.78), isolatus ex agro maydico prope Acacías, Feb. 1978.

Colonies on oatmeal agar reaching 3.5-4.5 cm diam in 6 days at about 20° C (up to 9 cm diam in 3 days at 24-30° C), finely floccose, centrally dark green to dark herbage green (Rayner 33'k); reverse uncoloured. Odour fain, typical of the genus. *Vegetative hyphae* 3-9 μm wide. *Conidiophores* profusely, densely pyramidally branched, without (or with very few) sterile ends; main branches 3.5-4 μm wide, subterminal ones 2.0-2.5 μm. Phialides in some what irregular clusters, legeniform, consisting of a swollen, 2.3-3.0(-3.5) μm wide venter and a 0.5-1.0 μm long, narrow neck; total length 4-5 μm; terminal phialides up to 8 μm long. *Conidia* globose to slightly ovoid, smooth-walled, at full maturity appearing green in the microscopic mount, 2.3-3.0 x 2.0-2.6 μm. *Chlamydospores* globose, mostly intercalary, hyaline, 4.5-6 μm diam. Teleomorph unknown. Temperature optimum 24-30° C., maximum 36° C.

MATERIAL EXAMINED:

CBS 273.78, 274.78, isolated from maizefield soil near Acacías, Dep. Meta, coll. *O. Rangel, s. n.* 18 Feb. 1978.

CBS 416.52, isolated from twig of *Coffea sp.*, Surinam, *G. van den Ende*, 1952.

CBS 518.81, isolated from urban waste deposits, Ahrntal near Innsbruck, Austria, *Gudrun Gstraunthaler*, 1981.

DISCUSSION

Rifai (1969) provided a basis for the taxonomy of *Trichoderma* and formally distinguished nine species aggregates. These and two later species are keyed out in Domsch et al. (1980).

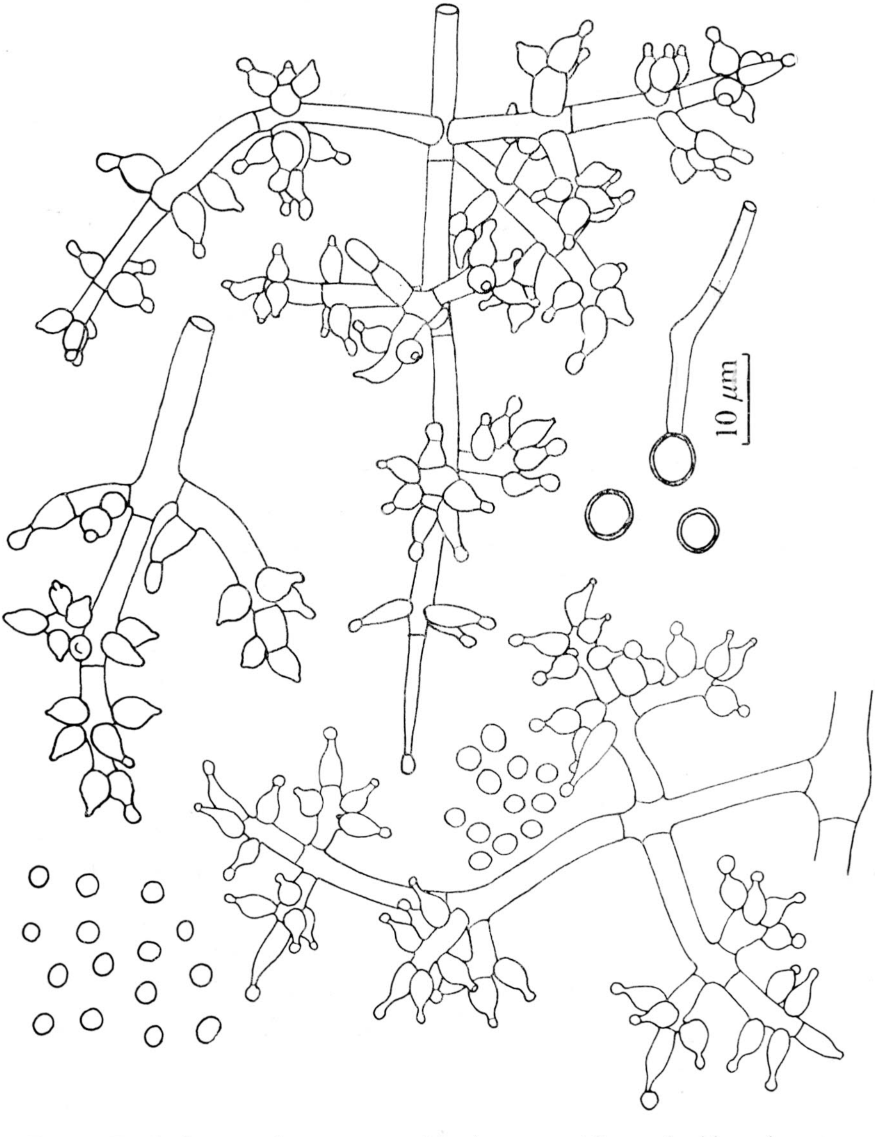

FIG. 1. *Trichoderma inhamatum*, conidiophores, conidia and chlamydospores.

T. inhamatum is close to *T. hamatum* (Bon.) Bain. and *T. harzianum* Rifai. It differs from the former by shorter conidia and the almost complete absence of sterile conidiophore ends (for this reason the epithet '*inhamatum*' was chosen), whilst the latter has more slender phialides with a longer neck, though similar slender phialides are also occasionally found in *T. inhamatum*.

Like the other anamorph species distinguished in *Trichoderma, T. inhamatum* is regarded as a species aggregate to which one Surinamese and one European isolate are assigned in addition to those from the type locality, which all have the same cordinal temperatures for growth. The closest to the type is CBS 518.81 with slightly larger conidia, 3.0-3.5 (-4.0) x 2.0-2.7 μm. CBS 416.52 has an orange-ocher colony reverse. Phialide shape is a somewhat variable character in *Trichoderma,* and again it has to be emplasized, that the distinctions made are based on optimally developed colonies, 5-8 days old, on oatmeal agar.

In view of the equivocal teleomorph connections of other species aggregates of *Trichoderma* (Domsch et al., 1980), no attempt is made here to correlate *T. inhamatum* with a particular *Hypocrea* species.

Further species of *Trichoderma* isolated from this maizefield soil are *T. hamatum* (Bon.) Bain., *T. harzianum* Rifai, *T. koningii* Oudem., *T. pseudokoningii* Rifai and *T. longibrachiatum* Rifai (the latter with much darker and larger conidia than *T. pseudokoningii)*.

Rhinocladiella phaeophora Veerkamp & W. Gams, sp. nov. Fig. 2.

Coloniae lente crescentes, post 15 dies ad 20 mm diam, velutinae vel lanosae, griseo-olivaceae, reverso olivaceo-nigro. Hyphae vegetativae submersae dilute olivaceae, latitudine regulares (1.5-2.5 μm) vel irregulariter geniculatae. Hyphae aeriae olivaceo-brunneae, 2.0-2.5 μm latae. Conidiophora praecipue in media colonia ex hyphis aeriis oriunda, olivaceo-brunnea, simplicia vel parce ramosa, pluricellularia, sympodialiter ad 320 μm elongascentia; parte inferiore 10-60 μm longa sterili, sursum omnino denticulis conidiiferis 5.0-0.7 μm diam. obtecta. Conidia breviter cylindrica, sursum rotundata, ad basim cicatrice minuta obscuriore praedita, subhyalina, fere tenuitunicata, levia (4-5-) 5.5-6 (-7) x 1.5-2.0 (-2.5) μm, raro uniseptata, 5-8 μm longa. Chlamydosporae absentes. Teleomorphosis ignota.

Holotypus COL. *Leg. O. Rangel s.n.* (vivus CBS 496.78), isolatus ex agro maydico prope Acacías, Feb. 1978.

Colonies on oatmeal or 2% malt extract agars growing restrictedly, reaching about 2.0 cm diam. in two weeks at about 20° C (2.5 cm at 24-30° C), grey-olivaceous (Rayner 21'' ''i), centrally velvety to lanose, with mainly

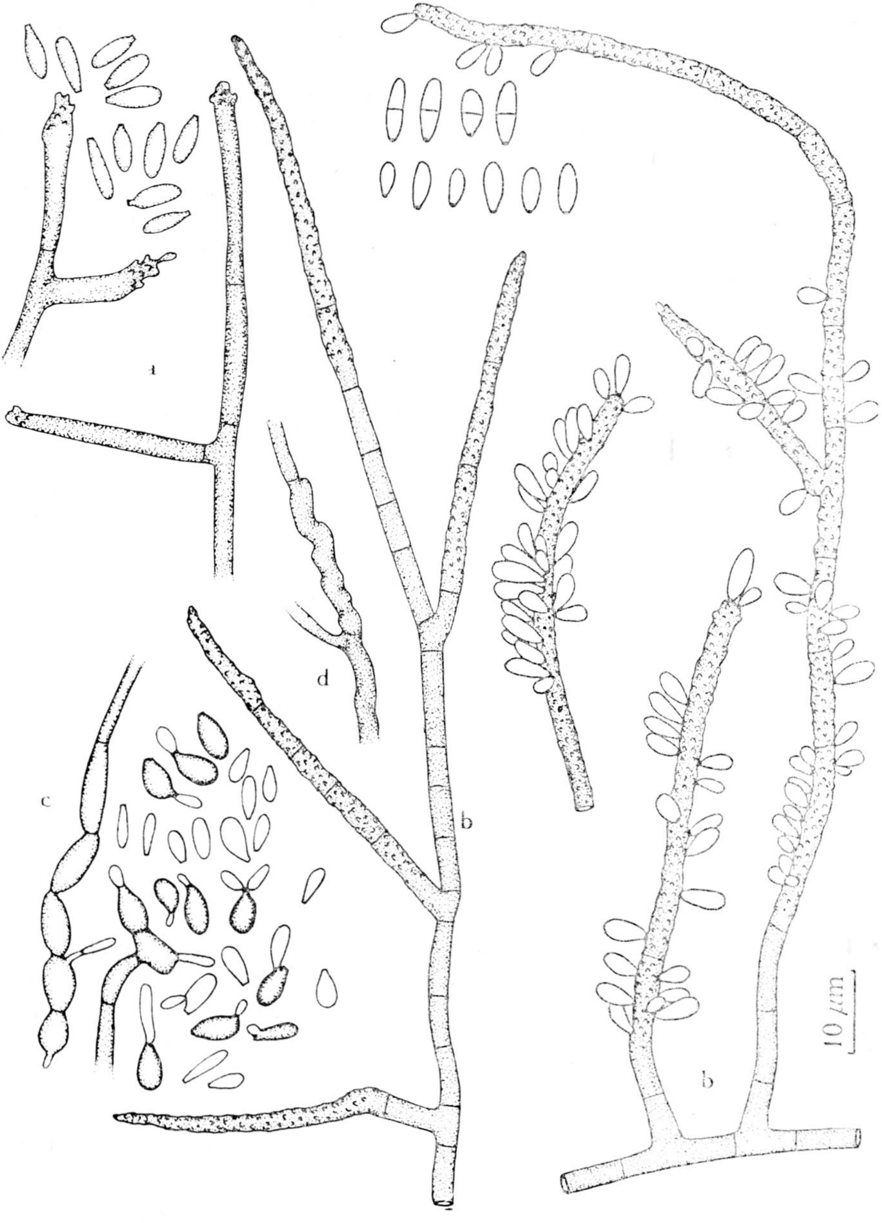

FIG. 2. *Rhinocladiella phaeophora,* a. short conidiophore in 4-year-old culture, b. conidiophores with long sympodial elongations in fresh isolate, c. yeast-like budding and moniliform hyphae developing from single conidia, d. ageniculate vegetative hypha.

submerged mycelium towards the regular and sharp margin; reverse olivaceous-black. Submerged *vegetative hyphae* pale olivaceous, of regular width (1.5-2.5 µm) or irregularly geniculate but normally not moniliform. When single conidia are spread on the agar, moniliform hyphae and yeast-like budding cells embedded in slime may initially appear. Aerial hyphae darker, olivaceous-brown, 2.0-2.5 µm wide. *Conidiophores* appearing mainly in the centre of the colony, arising from aerial hyphae, olivaceous-brown, consisting of a more or less racemoselly branched, multiseptate system of sterile and fertile cells. Intercalary and terminal cells 5-25 (-45) x 2.0-2.5 µm; main stalk sympodially elongating up to about 320 µm, fertile along the entire length except for about 10-60 µm at the base and only rarely branched, or with some shorter lateral branches arising at acute angles just below a septum. Conidiogenous cells provided with crowded, slightly prominent, pigmented conidiiferous denticles, about 0.5-0.7 µm diam. *Conidia* short-cylindrical to somewhat fusiform, with rounded upper and truncate basal end, sybhyaline, scar slightly darker, rather thin-walled, smooth-walled (4.5-) 5.5-6 (-7) x 1.5-2.0 (-2.5) µm, rarely 1-septate and 5-8 µm long. Chlamydospores absent. Teleomorph unknown.

Temperature optimum for growth 24-30° C, maximum near 30° C, but 36° C is survived for at least 1 week.

DISCUSSION

The slow-growing dark colonies, shape of the conidia and the budding cells of *Exophiala*-type (Fig. 2c) resemble those of *Rhinocladiella atrovirens* Nannf. For this reason we classify the present fungus in *Rhinocladiella* Nannf., rather than in *Ramichloridium* Stahel ex de Hoog, which would otherwise be a suitable genus because of the more differentiated and longer conidiophores. The longer and darker conidiophores (alluded to in the epithet '*phaeophora*') and the broader and darker conidial bases distinguish the new species from *Rh. atrovirens*. In freshly isolated cultures the conidiophores were little branched, with stalks arising from aerial hyphae, mostly very long, bearing conidia along nearly the entire length (Fig. 2b). After one or two transfers on artificial media, the branched condiophores were more common and the conidiiferous rhachis remained shorter (Fig. 2a). A similar change in conidiophore branching was described by de Hoog (1977) in *Ramichloridium anceps* (Sacc. & Ellis) de Hoog (= *Rhinocladiella anceps)* (Sacc. & Ellis) Hughes; the species at hand also resembles this species, but differs it by longer conidia; as budding cells and moniliform hyphae are also rarely observed in this species (de Hoog, 1977), it may be preferable to retain it in *Rhinocladiella*. Occasional septation of non-catenate conidia was not yet known in *Rhinocladiella*.

Mortierella ornata W. Gams, sp. nov. Fig. 3.

Coloniae fere celeriter crescentes (optime 15-21° C), vix zonatae, margine regulari, mycelio aerio quasi nullo; odor debilis. Sporangiophora numerosa ex hyphis submersis oriunda, vulgo simplicia, 250-500 (-700) µm alta, e 12-17 µm sursum ad 4-8 µm paulatim angustata. Sporangia (17-) 24-40 (-70) µm diam., (1-) 3- multispora; dilapsa collare inconspicuum relinquentia. Sporae isodiametricae vel elongatae vel irregulariter lobatae, plus minusve angulares, tunica externa verrucosae ad alatae, 7-20 (-30) µm diam., minores e sporangiis multisporis oriundae. Chlamydosporae plus minusve globosae, tenuitunicatae, intercalares vel terminales copiosae in agaro, 8-14 (-20) µm diam., nonnullae etiam terminales in hyphis erectis aeriis, ad 25 µm diam., sporangiis abortivis similes. Zygosporae ignotae.

Holotypus COL., Leg. *O. Rangel s.n.* (vivus CBS 348.77, syntypus vivus CBS 347.77), isolatus e terra humosa forestae montanae (sub Weinmanniae et Clusiae speciebus), 3.100 m alt., Parque Nacional del Puracé, Cauca-Huila, Cordillera Central, coll. *T. van der Hammen* et *R. Jaramillo, s.n.*, Jul. 1976.

Colonies on 2% malt extract agar reaching 6.5-8.5 cm diam. in 9 days at about 20° C, with little aerial mycelium, margin even, sometimes slightly zonate; odour faint, suggesting garlic. Sporulation abundant on cherry decoction, potato-carrot and soil extract agars. Sporangiophores arising singly or in groups from submerged hyphae, unbranched (though sometimes arising from procumbent sporangiophores which thus appear branched), 250-500 (-700) µm tall, from 12-17 µm gradually tapering to 4-8 µm at the tip. Sporangia (17-) 20-40 (-70) µm diam., (1-) 3->40-spored, leaving an inconspicuous flaring collarette on dehiscense. Spores isodiametric, elongate or irregulary lobate, 7-20 (-30) µm diam. (smaller in many-spored sporangia), more or less angular, covered with a loose outer membrane which renders them irregularly warted and winged at the edges. Chlamydospores abundantly produced as more or less globose, thin-walled hyphal swellings, 8-14 (-20) µm diam., intercalary or terminal, sometimes in nests; sometimes also borne terminally on erect aerial hyphae, up to 25 µm diam. and difficult to distinguish from abortive sporangia. Zygospores unknown.

Temperature optimum 15-21° C, maximum 27° C.

DISCUSSION

In spite of the sometimes apparently branched sporangiophores, this species is placed in section *Simplex*, it has already been keyed out in this section by Gams (1977), though it should have been placed closer to *M. angusta* (Linnem.) W. Gams rather than *M. rostafinskii* Bref. A comparable

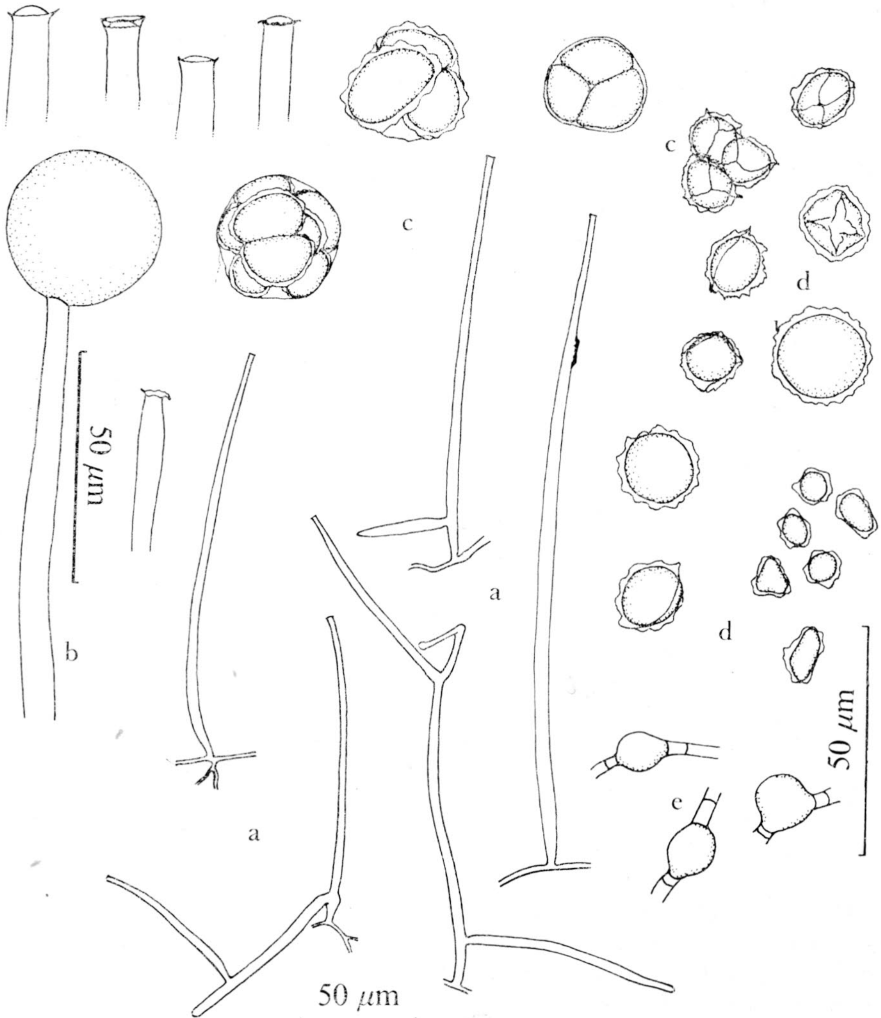

FIG. 3. *Mortierella ornata,* a. sporangiophores, some apparently branching, b. sporangiophore tips, one with attached sporangium, c. few-spored sporangia, d. free sporangiospores from few-spored and many-spored sporangia, e. chlamydospores; b-e at stronger magnification.

continuous variation between one-or few-spored sporangia with large spores, and many-spored sporangia with smaller spores, is shown in *M. angusta* (Gams, 1963). The latter also has spores with a loose outer wall but with less conspicuous, non-angular ornamentation and, therefore, the present species is named *'ornata'*.

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